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ABSTRACT

This module is the first in a series of 12 learning modules designed to teach occupational mathematics. Designed for improving machine shop technology skills, this module begins with an introduction to the topic. Blocks of informative material and rules are followed by examples and practice problems. The solutions to the practice problems are found at the end of the module. Specific topics covered include digits, place value, and decimals. (YLB)

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Fundamentals of OCCUPATIONAL MATHEMATICS

ED327700

Module 1

Place Value

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INTRODUCTION

Every person in our society uses numbers. We use numbers at home, during leisure games and while we are doing our job. The subject which explains how numbers are used in these and other activities is called mathematics. Due to a variety of life styles, we each need and use different kinds and amounts of mathematics. The ideas of mathematics studied here are those needed by a person who applies machine shop technology skills.

Numbers are an important part of how we communicate ideas between people. To effectively communicate an idea or design requires the use of numbers. Numbers may be used in counting objects to obtain a total quantity or to determine the size of an object from its measurements. The English language and the language of mathematics share an equally important role in technology so ideas can be passed from person to person.

Computations with a calculator will be an important feature of this course work. It is recommended that a person start with the right calculator. The calculator should have the following design features:

(1) Algebra logic computation steps:
3 + 9 = displays 12.
Avoid RPN (Reverse Polish Notation) type where above problem is 3 enter 9 + displays 12.

(2) A fairly rugged design

(3) A fold over cover to help keep the face clean

(4) Keys large enough that one doesn't often press them two or three at a time

(5) Keys which depress gently, smoothly

(6) Special keys for π, x^2, $1/x$, y^x, sin x, cos x, tan x without an excessive number of other capabilities (all have keys +, −, x, ÷, =)

(7) Reasonably large digits on the display

(8) Consider trading in (or putting in front of either rear wheel) a calculator which uses RPN.

Module 1 -- PLACE VALUE

Throughout history different cultures have used their own number system. Occasionally, the Roman number system is still used. The best of the ancient number systems, invented by the Hindu people 1300 years ago, is the only one to survive through time. What is now used world-wide is an improvement of that system. The idea of that system was adopted and shown to the Western world by Arab travelers. Credit is given to both cultures when calling our number system the Hindu-Arabic system. It is more commonly called the decimal system because the number system is based upon ten. Whole numbers are written using only ten digits (0, 1, 2,$\cdots$, 9) and a plan which makes it possible to write larger and larger whole numbers.

The single digit number 4 means four units. Whole numbers greater than 9 are written by combining two or more digits. The four in 43 means 4 x 10 or forty. The 4 of 43 is said to be in the tens place. The three digit number 481 has its 4 mean 4 x 10 x 10 = 4 x 100 or 400. The 4 of 481 is said to be in the hundreds place. Meanwhile, 4,697 contains digit 4 representing 4 x 10 x 10 x 10 = 4 x 1000 or four thousand. The 4 of 4,697 is in the thousand place.

RULE: The right-hand digit of a whole number is in a place called "units". Each place value toward the left in a whole number is ten times greater than the one on its immediate right.

When whole numbers are larger than one thousand, its digits are blocked, using commas, into groups of three digits working left from the units digit. The number 14872 is grouped as 14,872. The number 73859176 is grouped as 73,859,176.

The blocks of digits are given a group name and place value names are assigned to each digit of a three digit group. The examples below show the names associated with the place values of groups and digits:

EXAMPLE 1:

1	4	,	8	7	2
	T		H	T	U
	H		U	E	N
	O		N	N	I
	U		D		T
	S		R		
	A		E		
	N		D		
	D				

The number 14,872 is read as
fourteen thousand eight hundred seventy-two.

EXAMPLE 2:

73 ,	859 ,	1 7 6
M	T	H T U
I	H	U E N
L	O	N N I
L	U	D T
I	S	R
O	A	E
N	N	D
	D	

The number 73,859,176 is read as seventy-three million eight hundred fifty-nine thousand one hundred seventy-six.

EXAMPLE 3:

85 ,	641 ,	2 3 9
M	T	H T U
I	H	U E N
L	O	N N I
L	U	D T
I	S	R
O	A	E
N	N	D
	D	

The number 85,641,239 is read as eighty-five million six hundred forty-one thousand two hundred thirty-nine.

PRACTICE PROBLEMS:

1. Consider the number 6,813:
   (a) What is the place value of the 6?
   (b) What is the place value of the 8?
   (c) What is the place value of the 1?
   (d) What is the place value of the 3?
   (e) Write the word name of this number.

2. Consider the number 47,539:
   (a) What is the place value of the 7?
   (b) What is the place value of the 5?
   (c) What is the place value of the 3?
   (d) What is the place value of the 9?
   (e) Write the word name of this number.

3. Consider the number 9,704:
   (a) What is the place value of the 9?
   (b) What is the place value of the 7?
   (c) What is the place value of the 0?
   (d) What is the place value of the 4?
   (e) Write the word name of this number.

4. Consider the number 218,735:
   (a) What is the place value of the 7?
   (b) What is the place value of the 8?
   (c) What is the place value of the 5?
   (d) What is the place value of the 3?
   (e) Write the word name of this number.

5. Consider the number 72,009,516
   (a) What is the place value of the 5?
   (b) What is the place value of the 2?
   (c) What is the place value of the 6?
   (d) What is the place value of the 1?
   (e) What is the palce value of the 9?
   (f) Write the word name of this number.

6. Write a three digit whole number whose units digit is 5, tens digit is 8 and hundreds digit is 2.

7. Write a four digit whole number whose tens digit is 3, hundreds digit is 7, units digit is 1 and thousands digit is 5.

8. Write a four digit whole number whose tens digit is 7, thousands digit is 4, and the remaining digits are 0.

9. Write a whole number for 23 thousands, hundreds digit is 8, tens digit is 2 and no units.

10. Write a four digit whole number whose digits are each a six.

Decimals are a relatively new invention (400 years old) to represent numbers. Whenever it is necessary to write part of the whole number 1, a decimal or a fraction will need to be used. Fractions will be studied later. The base of the Hindu-Arabic (decimal) system, as mentioned previously, is ten. Each place value of a whole number from the units place toward the left is ten times greater. Reversing the direction would mean that, when looking at place values from left to right, each place value is one-tenth of the previous. The place values in the number 287.53 have the pattern that follows:

Since the 2 is in the 100's place, the place value of the 8 is the $100 \div 10 = 10$'s place. Since the 8 is in the 10's place, the 7 is in the $10 \div 10 = 1$'s place, called units. When the 7 is in the 1's place, then the next digit 5 is in the place called $1 \div 10 = 1/10 = 0.1$, tenths place. Finally, three is in place $1 \div 10 \div 10 = 1/100 = .01$ or hundredths place.

The examples below show the names associated with the place values of a decimal number

EXAMPLE 4:

3	4	.	8	1	9	7	5	2
T	U		T	H	T	T	H	M
E	N		E	U	H	E	U	I
N	I		N	N	O	N	N	L
	T		T	D	U	|	D	L
			H	R	S	T	R	I
				E	A	H	E	O
				D	N	O	D	N
				T	D	U	|	T	H
				H	T	S	T	H	
					H	A	H	O	
						N	O	U	
						D	U	S	
						T	S	A	
						H	A	N	
							N	D	
							D	T	
							T	H	
							H		

Notice the hyphens in ten-thousandth and hundred-thousandth.

EXAMPLE 5: Consider the number 1,893.274:

The place value of the 9 is called ten.
The place value of the 2 is called tenth.
The place value of the 7 is called hundredth.
The place value of the 8 is called hundred.
The place value of the 4 is called thousandth.
The place value of the 1 is called thousand.

EXAMPLE 6: Consider the measurement 0.91875 mm. The last place value is a reflection of its precision. The 5 is in the last place value called hundred-thousandths.

PRACTICE PROBLEMS:

11. Consider the number 26.8417, what is
    (a) the place value of the 2?
    (b) the place value of the 6?
    (c) the place value of the 8?
    (d) the place value of the 4?
    (e) the place value of the 1?
    (f) the place value of the 7?

12. Consider the number 3.06924, what is
    (a) the place value of the 3?
    (b) the place value of the 0?
    (c) the place value of the 6?
    (d) the place value of the 9?
    (e) the place value of the 2?
    (f) the place value of the 4?

13. Consider the number 0.753862, what is
    (a) the place value of the 0?
    (b) the place value of the 7?
    (c) the place value of the 5?
    (d) the place value of the 3?
    (e) the place value of the 8?
    (f) the place value of the 6?
    (g) the place value of the 2?

14. Consider the measurement 5.091 inches. The last place value is a reflection of its precision. The 1 is in the place value_____.

15. Consider the measurement 4.3006 mm. The place value is a reflection of its precision. The 6 is in the last place value of_____.

16. Consider the measurement 0.07253 inches. The last place value is a reflection of its precision. The 3 is in the last place value of_____.

To use words to read and write decimal numbers, like 0.082, which are less than one, use the following steps:

(1) Identify the place value of its right hand digit,

(2) Imagine the whole number you get when you disregard the leading zeros and decimal point,

(3) Read or write the name of the whole number name followed by place value name.

The number 0.082 has its last digit in place value thousandth. Disregarding the leading 0's and decimal point makes the number 82. The number 0.082 is written as eighty-two thousandths.

EXAMPLE 7: Write 0.94 in words.

Solution: The 4 is in the place value hundredth.
Disregarding the 0, forms 94.
The number 0.94 is ninety-four hundredths.

EXAMPLE 8: Write 0.7035 in words.

Solution: The 5 is in place value ten-thousandth.
Disregarding the 0, forms 7035.
The number 0.7035 is seven thousand thirty-five ten-thousandths.

The name of the whole number part is connected to the decimal part by the word "and".

EXAMPLE 9: Write 12.070 in words.

Solution: Whole number part is 12, twelve.
Decimal part is .070 or 70 thousandths.
The number 12.070 is twelve and seventy thousandths.

EXAMPLE 10: Write 10.0010 in words.

Solution: Whole number part is 10 (ten).
Decimal part .0010 is 10 ending in place value ten-thousandths. The number 10.0010 is ten and ten ten-thousandths.

PRACTICE PROBLEMS: Write the following numbers:

17. sixty-three thousandths

18. nine hundred three thousandths

19. two hundred forty-seven ten-thousandths

20. eighteen hundred-thousandths

21. three and sixteen ten-thousandths

22. ninety-two and four hundredths

Write the following numbers in word form:

23. 0.012 _____ 24. 0.605 _____

25. 2.004 _____ 26. 3.0100 _____

27. 3.110 _____ 28. 0.00060 _____

SOLUTIONS TO PRACTICE PROBLEMS--MODULE 1

1. (a) thousand
   (b) hundred
   (c) ten
   (d) unit
   (e) six thousand eight hundred thirteen
2. (a) thousand
   (b) hundred
   (c) ten
   (d) unit
   (e) forty-seven thousand five hundred thirty-nine
3. (a) thousand
   (b) hundred
   (c) ten
   (d) unit
   (e) nine thousand seven hundred four
4. (a) hundred
   (b) thousand
   (c) unit
   (d) ten
   (e) two hundred eighteen thousand seven hundred thirty-five
5. (a) hundred
   (b) million
   (c) unit
   (d) ten
   (e) thousand
   (f) seventy-two million nine thousand five hundred sixteen

6. 285
7. 5,731
8. 4,070
9. 23,820
10. 6,666

11. (a) ten
    (b) unit
    (c) tenth
    (d) hundredth
    (e) thousandth
    (f) ten-thousandth

12. (a) unit
    (b) tenth
    (c) hundredth
    (d) thousandth
    (e) ten-thousandth
    (f) hundred-thousandth

13. (a) unit
    (b) tenth
    (c) hundredth
    (d) thousandth
    (e) ten-thousandth
    (f) hundred-thousandth
    (g) millionth

14. thousandth
15. ten-thousandth
16. hundred-thousandth
17. 0.063
18. 0.903
19. 0.0247
20. 0.00018
21. 3.0016
22. 92.04
23. twelve thousandths
24. six hundred five thousandths
25. two and four thousandths
26. three and one hundred ten-thousandths
27. three and one hundred ten thousandths
28. sixty hundred-thousandths